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1 380 873

PATENT SPECIFICATION

1 380 873

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(19)

(54) SYRINGE WITH SELF-RETURNABLE PLUNGER

(71) We, AMERICAN HOSPITAL SUPPLY CORPORATION, a Corporation organised and existing under the laws of the State of Illinois, United States of America, of 1740 Ridge Avenue, Evanston, Illinois, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to syringes, and more, particularly, to piston-type syringes suitable for medical use.

The invention finds particular utility in medical irrigation syringes but is not limited to that particular type of syringe. Irrigation syringes, which may be used in irrigating incisions, wounds, body passages, wet dressings or the like, are generally of two types — the piston-type or the bulb-type. A piston syringe includes a barrel and a piston or plunger which is slidable longitudinally within the barrel to eject fluid from the barrel or to draw fluid into the barrel. A bulb syringe includes a barrel and an elastic bulb which is squeezed to eject fluid from the barrel and released to draw fluid into the barrel. A variation of the bulb syringe is the bellows syringe in which a bellows is collapsed to eject fluid and allowed to expand to draw fluid into the barrel.

Each of these syringes has advantages and disadvantages. For example, a piston syringe can exert a relatively large force, particularly during suction when the plunger is withdrawn to draw fluid into the barrel. However, a problem with this type of syringe is that too much force may be delivered or provided. Further, the operator must use both hands to withdraw the plunger — one hand to grasp the barrel and the other to pull the plunger.

A bulb syringe provides a more gentle suction action, but if the nozzle of such a syringe becomes clogged during suction, expansion of the bulb will be prevented and a positive return force cannot be applied by the operator as in the case of a piston syringe.

According to the invention a syringe has an elongate tubular barrel with an open rear end and an orifice at the front end, a plunger slidably disposed in the barrel and projecting from the open rear end thereof, an elastic member extending between the barrel and the plunger, the member including a first portion engaging the rear end of the barrel and being restrained against longitudinal movement thereby, a second portion engaged by the plunger for longitudinal movement therewith, the member being stretchable toward the front end of the barrel, the rear end of the barrel terminating in a plurality of longitudinally extending relatively sharp projections engaging the first portion of the member to hold the first portion of the member as the member is stretched toward the front end of the barrel.

As the plunger is depressed, the elastic member is stretched and creates a restoring force which acts to restrain delivery of fluid. When the pressure on the plunger is released, the elastic member returns the plunger to its original position while the syringe can be held by one hand. Even though the member is tensioned considerably as the plunger is depressed, the rear portion or anchor of the member is securely anchored against longitudinal movement with the plunger by means of the longitudinally extending pointed projections on the barrel. The rear portion or anchor of the member is preferably annular and passes over these projections, and the projections dig into it as the member is tensioned. The projections are preferably moulded integrally with the barrel and are provided with sharp points without the necessity of any finishing operations. The syringe may be produced inexpensively enough to allow it to be discarded (and incinerated) after a single use, thereby avoiding the serious

problems of cross contamination which has been found to arise when instruments are reused, even after supposedly effective "sterilizing" procedures.

An embodiment of the invention will be described by way of example, reference being made to the accompanying drawings, in which:—

FIG. 1 is a perspective view of a syringe;

FIG. 2 is an exploded view of the barrel of the syringe and the member;

FIG. 3 is an elevational view, partially broken away, of the syringe with the plunger being depressed;

FIG. 4 is a fragmentary view similar to FIG. 3 showing the plunger in its non-depressed position;

FIG. 5 is an elevational view partially broken away of the member in an untensioned state;

FIG. 6 is a sectional view taken along line 6—6 of FIG. 5;

FIG. 7 is a sectional view taken along line 7—7 of FIG. 5;

FIG. 8 is an enlarged fragmentary plan view of the barrel;

FIG. 9 is a fragmentary view taken along line 9—9 of FIG. 8;

FIG. 10 is a sectional view taken along line 10—10 of FIG. 9;

FIG. 11 is a fragmentary sectional view taken along the line 11—11 of FIG. 10; and

FIG. 12 is a fragmentary view taken along line 12—12 of FIG. 8.

Numeral 15 designates generally a syringe which includes an elongated generally tubular barrel 16, a plunger or piston 17, and an elastic member 18 interposed therebetween. The particular syringe 15 illustrated is a medical irrigation syringe.

The barrel 16 includes a generally cylindrical body portion 19 and a generally frusto-conical nozzle portion 20 having an apertured forward end 21 through which fluids may pass. The barrel is provided with an open rear end 22, and the rear portion of the cylindrical wall of the barrel terminates in a plurality of pointed projections 23, which will be explained in detail hereinafter. A radially outwardly extending annular flange 24 is spaced longitudinally forwardly from the projections, and a pair of finger grips 25 extend radially outwardly from the flange at generally diametrically opposed positions.

The plunger 17 extends from the rear end of the barrel and is slidable within the barrel. The forward end of the plunger terminates in a generally cylindrical disc or plug portion 27 (FIG. 3), and the other end terminates in a radially enlarged disc portion 28 adapted to be pressed by the thumb of the operator. The particular plunger illustrated includes a central portion 29 formed of four intersecting planar portions or ribs 30 which provides an economical and light yet extremely sturdy plunger. An annular groove 31 is provided in the forward disc portion 27 for cooperation with the member as will be explained more fully hereinafter.

The elastic member 18 includes a barrel attaching first portion or anchor 33 and a plunger or second portion or element 34 joined by elastic means comprising three resiliently extensible bands 35. Referring particularly to FIGS. 3 and 5, the plunger portion or element 34 of the member includes a generally cylindrical wall portion 36, a frusto-conical nose 37, and an elongated, somewhat bullet-shaped projection 38 which is shaped to be received by the nozzle portion 20 of the barrel and which serves to force a greater amount of fluid from the barrel. A pair of longitudinally spaced annular sealing ribs or flanges 39 and 40 extend radially outwardly from the cylindrical wall 36 and are sized to be compressed by the inner surface 22 of the cylindrical body of the barrel to provide a fluid seal therewith. An annular attaching flange 41 extends inwardly from the wall 36 generally opposite the upper rib 39 and is received by the annular groove 31 of the plunger to secure the element or second portion to the plunger for longitudinal movement therewith in either direction.

The barrel-attaching portion or anchor 33 includes an annular rear wall 42 which extends radially outwardly from the longitudinally extending bands 35 and a longitudinally extending cylindrical outer wall 43 which has an inside diameter slightly less than the outside diameter of the barrel. The elastic means or connecting bands or strips 35 extend between the plunger portion or element 34 and the inner edge of the annular rear wall 42 of the barrel-attaching portion or anchor 33, the three connecting strips or bands being spaced circumferentially 120° apart. It is to be understood however, that the number and location of the connecting bands can be varied, and the barrel-attaching portion or anchor and plunger portion or element may even be connected by a continuous, generally cylindrical connecting wall.

Referring now to FIGS. 8 to 11, the projections 23 at the rear of the barrel are seen to be generally pyramidal and include a generally triangular arcuate surface 46 which extends longitudinally from the outer surface of the cylindrical barrel and which has the same curvature. This arcuate surface has a pair of inclined side edges 47 which form an included angle in the range of 45° to 60°, and a pair of planar triangular surfaces 48 and 49 extend from these inclined edges 47 and intersect along line 50 which extends from the inner surface of the cylindrical

barrel to the apex 51 of the arcuate outer surface 46. Each inclined side edge 47 of each arcuate surface intersects with an inclined side edge of an adjacent projection to provide the barrel with a continuous sawtooth-like rear end. The planar surfaces 48 and 49 terminate at a planar ledge 52 which extends radially inwardly from the intersections of the inclined side edges 47 of adjacent projections.

The shape of the sawteeth or projections enables the teeth and the remainder of the barrel to be moulded integrally from plastics, and the three intersecting surfaces which form the teeth provide a sharp apex without the need of finishing operations. In one specific embodiment the included angle between the side edges 47 of each tooth was about 55°, and each side edge extended at an angle of about 62.5° from the planar ledge 52. The included angle between inclined edges 47 of adjacent teeth was also about 55°, and the wall of the barrel was about 1/16 inch thick.

Referring now to FIGS. 3 and 4, the barrel-attaching portion of the member is secured to the rear end of the barrel by sliding the outer wall 43 of the rear portion of the member forwardly over the rear end of the barrel. The outer wall 43 is sized to be received relatively snugly on the barrel, and the points of the teeth 23, which lie along the cylindrical outer surface of the barrel, engage the barrel-attaching portion of the member at the juncture between the rear wall 42 and the outer wall 43.

When the syringe is not being used, the plunger and the member assume the position shown in FIG. 4. The connecting bands 35 of the member are in a relaxed, unstretched state and extend for only a minor portion for the length of the barrel.

When the syringe is to be used, the operator grasps the barrel between two fingers of one hand and depresses the plunger by forcing the disk portion 28 downwardly with the thumb, the finger grips 25 permitting the barrel to be firmly held. As the plunger moves downwardly, the connecting bands 35 stretch and tension the rear wall 42 of the membrane. However, as the inner edge of the annular rear wall is pulled downwardly by the bands, the teeth 23 dig firmly into the membrane and prevent the barrel-attaching portion of the membrane from being pulled into the barrel.

The plunger may be depressed until the desired volume of fluid will be drawn into the barrel upon release of the plunger, and the truncated cone portion 16a joining the tubular body of the barrel to the nozzle 20 provides a positive stop to ensure that the connecting bands 35 are not excessively stretched. After the plunger has been depressed the desired distance, the pressure exerted by the thumb may be released, and the stretched elastic connecting bands return the plunger toward its original position while the syringe is held with one hand. The seal provided by the annular ribs 39 and 40 will provide a gentle sucking action as the plunger returns, and fluid may be drawn into the barrel through the open end of the nozzle.

The fluid may be ejected from the barrel when desired by again depressing the plunger, and the elastic connecting bands provide a force which aids in preventing the fluid from being ejected too fast.

Under ordinary conditions the syringe requires the use of only a single hand. However, if the nozzle becomes clogged while the fluid is being drawn into the barrel or if additional suction force is desired, the plunger can be manually retracted. The plunger portion 34 is connected to the plunger by the inwardly extending flange 41, and a rearward pull on the plunger will also pull the plunger portion rearwardly.

Both the barrel and the plunger can advantageously and economically be formed of moulded plastics, and the member can be moulded from a suitable elastic material such as rubber, certain well known plastics, and the like. We have found that syringes formed in accordance with the invention can be produced cheaper than many of the syringes heretofore available, and allows our syringes therefore to be disposed of after a single use thereby eliminating possible cross-contamination if the syringe is used more than once.

If it is desired to use the syringe a number of times, the various parts thereof can easily separated for cleaning. The member can be separated from the barrel merely by withdrawing the barrel attaching portion rearwardly from the barrel as the plunger is withdrawn, and the plunger portion of the member can be removed from the plunger by flexing the attaching flange 41 away from the annular groove 31 in the plunger. Similarly, if the member becomes fatigued through excessive use, it can easily be replaced with a new member.

WHAT WE CLAIM IS:—

1. A syringe having an elongate tubular barrel with an open rear end and an orifice at the front end, a plunger slidably disposed in the barrel and projecting from the open rear end thereof, an elastic member extending between the barrel and the plunger, the member including a first portion engaging the barrel at the rear end thereof and being restrained against longitudinal movement thereby, a second portion engaged by the plunger for longitudinal movement therewith, the member being stretchable toward the front end of the

barrel as the plunger is moved longitudinally toward the front end of the barrel, the rear end of the barrel terminating in a plurality of longitudinally extending relatively sharp projections engaging the first portion of the member to hold the first portion of the member as the member is stretched toward the front end of the barrel.

2. The syringe of claim 1 in which the tubular barrel includes a generally cylindrical wall and the projections extending longitudinally from the wall have apexes circumferentially spaced.

3. The syringe of claim 1 in which the barrel is formed of moulded plastics and includes a generally cylindrical wall and the projections are moulded integrally with the wall and extend longitudinally from the wall with apexes which are circumferentially spaced.

4. The syringe of claim 3 in which each projection is generally pyramidal and includes an arcuate generally triangular surface extending longitudinally from the outer surface of the cylindrical wall of the barrel and has a pair of inclined side edges terminating in a pointed apex, and a pair of substantially planar generally triangular surfaces, each planar surface extending from one of the inclined side edges and intersecting the other planar surface along a line extending from the inner surface of the barrel to the apex.

5. The syringe of claim 4 in which each inclined side edge of each projection intersects an inclined side edge of the adjacent projection.

6. The syringe of claim 4 in which the inclined angle between the inclined side edges of each projection in the range of 45° to 60°.

7. The syringe of claim 1 in which the first portion of the member includes an annular rear wall extending radially outwardly adjacent to the projections on the rear end of the barrel and an outer wall extending longitudinally from the annular rear wall along the outside of the barrel, the projections engaging the annular rear wall for anchoring the first portion of the member when the plunger and the second portion of the member move toward the orifice of the barrel.

8. A syringe comprising an elongate tubular barrel having an open rear end and an apertured front end, a plunger slidable within the barrel and normally extending from the rear end thereof, an element disposed within the barrel between the plunger and the front end of the barrel, the element being displaceable by the plunger toward the front end of the barrel against the restoring force of elastic means connecting the element to an anchor, the anchor engaging relatively sharp projections extending longitudinally from the rear end of the barrel.

9. A syringe substantially as hereinbefore described with reference to the accompanying drawings.

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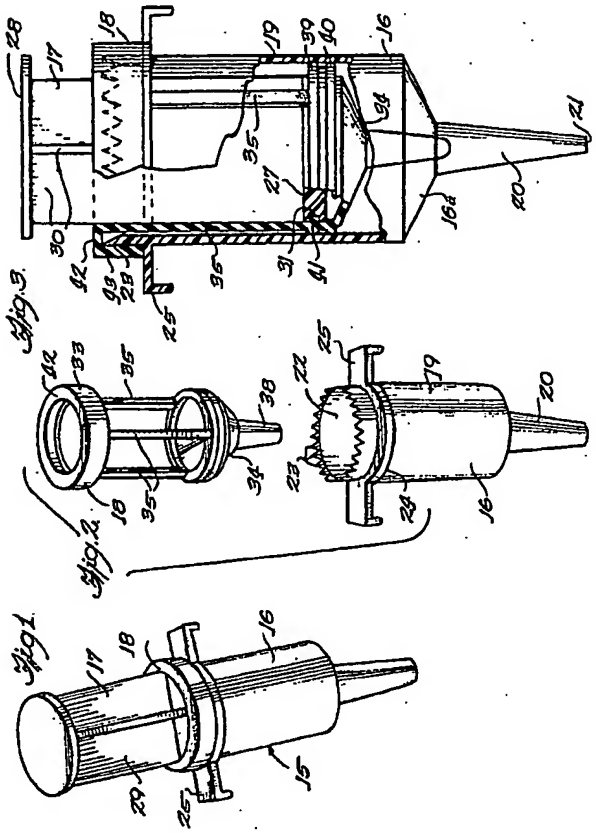

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Sheet 2